



UNITED STATES PATENT AND TRADEMARK OFFICE

KEH
UNITED STATES DEPARTMENT OF COMMERCE
United States Patent and Trademark Office
Address: COMMISSIONER FOR PATENTS
P.O. Box 1450
Alexandria, Virginia 22313-1450
www.uspto.gov

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/014,418	12/14/2001	Katsumi Nakagawa	35.C16024	9769

5514 7590 05/03/2004

FITZPATRICK CELLA HARPER & SCINTO
30 ROCKEFELLER PLAZA
NEW YORK, NY 10112

EXAMINER

SONG, MATTHEW J

ART UNIT	PAPER NUMBER
----------	--------------

1765

DATE MAILED: 05/03/2004

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary

Application No.

10/014,418

Applicant(s)

NAKAGAWA ET AL. 

Examiner

Matthew J Song

Art Unit

1765

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 20 February 2004.
- 2a) ☒ This action is **FINAL**. 2b) ☐ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 1-52 is/are pending in the application.
- 4a) Of the above claim(s) 12-25 and 38-51 is/are withdrawn from consideration.
- 5) ☐ Claim(s) _____ is/are allowed.
- 6) ☒ Claim(s) 1-11, 26-37, and 52 is/are rejected.
- 7) ☐ Claim(s) _____ is/are objected to.
- 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on _____ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some * c) ☐ None of:

1. ☐ Certified copies of the priority documents have been received.
2. ☐ Certified copies of the priority documents have been received in Application No. _____.
3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

- 1) ☐ Notice of References Cited (PTO-892)
- 2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
- 3) ☐ Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08)
Paper No(s)/Mail Date _____
- 4) ☐ Interview Summary (PTO-413)
Paper No(s)/Mail Date. _____
- 5) ☐ Notice of Informal Patent Application (PTO-152)
- 6) ☐ Other: _____

DETAILED ACTION

Continued Examination Under 37 CFR 1.114

1. A request for continued examination under 37 CFR 1.114, including the fee set forth in 37 CFR 1.17(e), was filed in this application after final rejection. Since this application is eligible for continued examination under 37 CFR 1.114, and the fee set forth in 37 CFR 1.17(e) has been timely paid, the finality of the previous Office action has been withdrawn pursuant to 37 CFR 1.114. Applicant's submission filed on 2/20/2004 has been entered.

Election/Restrictions

2. This application contains claims 12-25 and 38-51 drawn to an invention nonelected with traverse in the Paper filed on 9/2/2003. A complete reply to the final rejection must include cancellation of nonelected claims or other appropriate action (37 CFR 1.144) See MPEP § 821.01.

Claim Rejections - 35 USC § 103

3. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

This application currently names joint inventors. In considering patentability of the claims under 35 U.S.C. 103(a), the examiner presumes that the subject matter of the various claims was commonly owned at the time any inventions covered therein were made absent any

evidence to the contrary. Applicant is advised of the obligation under 37 CFR 1.56 to point out the inventor and invention dates of each claim that was not commonly owned at the time a later invention was made in order for the examiner to consider the applicability of 35 U.S.C. 103(c) and potential 35 U.S.C. 102(e), (f) or (g) prior art under 35 U.S.C. 103(a).

4. Claims 27-29, 33-37 and 52 are rejected under 35 U.S.C. 103(a) as being unpatentable over O'Neill (US 4,243,472) in view of Dauncey (US 2,759,803).

O'Neill discloses a method for liquid phase epitaxy of multiple wafers, note entire reference, comprising a crucible **14** filled with a melt material **16** to be epitaxially deposited on substrates (col 2, ln 15-35). O'Neill also discloses a substrate holder **10** and supporting a plurality of wafers **12** substantially horizontal and lowering and immersing the wafers into a melt to deposit a thin film on each wafer (col 1, ln 60-68) using a dipping rod member **18** connected at one end to a means for raising and lowering the substrate into the crucible (col 2, ln 36-67). O'Neill also discloses the substrate is disposed at a position set aside from the center of the crucible (Figs 2-4). O'Neill also discloses continually oscillating **30** the wafers through substantially 360°C (col 2, ln 1-2, col 4, ln 10-20 and Figs 2-4); this reads on applicant's rotation of the supporting rack during crystal growth. O'Neill et al also teaches any apparatus capable of supporting and dipping a plurality of substrate in a melt filled crucible may be used so long as the apparatus is capable of raising, lowering and oscillating the substrate while in the flux (col 2, ln 29-34).

O'Neill does not disclose no part of the substrate is disposed at the center of rotation of the supporting rack. However, O'Neill is open to using other support apparatuses.

In an apparatus for growing crystals, note entire reference, Dauncey teaches a supports 1 used for mounting crystals in a crystal growing tank. The support comprises a shaft 2 to which circular horizontal shelves are secured by struts projection from collars on the shaft. The support may be rotated about the longitudinal axis of the shaft and no part of the substrates are disposed at the center of rotation of the supporting rack (Figs 1-2 and col 2, ln 45 to col 3, ln 25). Dauncey also teaches a winch 19 for withdrawing the support and lowering the support (col 3, ln 25 to col 4, ln 20).

It would have been obvious to a person of ordinary skill in the art at the time of the invention to modify O'Neill with Dauncey's support rack because a larger number of substrates can be supported, which increasing productivity.

Referring to claims 28 and 34, the combination of O'Neill and Dauncey teaches the substrates are arranged substantially horizontal, this reads on applicant's substantially parallel to the flow of the melt.

Referring to claim 29, the combination of O'Neill and Dauncey is silent to the flow of the melt is caused by the rotation of the supporting rack. This is inherent to the combination of O'Neill and Dauncey because the combination of O'Neill and Dauncey teaches a similar method of rotating the supporting rack, as applicant.

Referring to claim 33, the combination of O'Neill and Dauncey discloses raising and lowering the substrates into the crucible (col 2, ln 35-41).

Referring to claim 35, the combination of O'Neill and Dauncey discloses a group of substrates arranged keeping stated intervals one another in the direction which falls at right angles with the axis of the center of rotation of the supporting rack ('803 Fig 1 and Fig 2).

Referring to claim 36-37, the combination of O'Neill and Dauncey teaches the substrate comprises a plurality of groups independent from one another and all groups are immersed in the same melt and the plurality of groups of substrates are disposed around the axis at the center of rotation of the supporting rack ('803 Figs 1-2).

Referring to claim 52, the combination of O'Neill and Dauncey discloses immersing the substrate in a substrate holder into a melt held in a crucible to grow a crystal by the liquid phase epitaxial method and the substrate holder is rotated.

5. Claim 31 are rejected under 35 U.S.C. 103(a) as being unpatentable over O'Neill (US 4,243,472) in view of Dauncey (US 2,759,803) as applied to claims 27-29, 33-37 and 52 above, and further in view of Ukiyo et al (JP 11-199376), as English Abstract has been provided.

The combination of O'Neill and Dauncey teaches all of the limitations of claim 31, as discussed previously, except a flow adjusting means is provided rotatably in the melt to make the flow of the melt inclined toward the center of rotation and/or the liquid surface of the melt.

In a liquid phase growing method, Ukiyo et al teaches melting a semiconductor and stirring structure independent of a substrate supporting stand and capable of carrying out the rotation and stirring independent of the supporting stand. Ukiyo et al also teaches the shape of a fin, this reads on applicant's flow adjusting means, for stirring is a twisted rectangular shape and the attaching angle thereof to the substrate supporting stand is 45° (Abstract and Fig 2). The shape of the fin, note Fig 2a, would inherently direct the melt toward the center of rotation. It would have been obvious to a person of ordinary skill in the art at the time of the invention to modify the combination of O'Neill and Dauncey with Ukiyo et al's flow adjusting means to

Art Unit: 1765

provide a liquid phase growing method by which efficient and homogeneous liquid phase growth on a substrate is enabled (‘ 376 Abstract)

6. Claim 32 are rejected under 35 U.S.C. 103(a) as being unpatentable over O’Neill (US 4,243,472) in view of Dauncey (US 2,759,803) as applied to claims 27-29, 33-37 and 52 above, and further in view of Kokta et al (US 4,293,371)

The combination of O’Neill and Dauncey teaches all of the limitations of claim 32, as discussed previously, except supporting rack is rotated alternately in the clockwise and anticlockwise directions.

In a liquid phase epitaxial (LPE) method of growth, note entire reference, Kokta et al teaches the LPE technique is practiced under isothermal conditions and a common practice is to continuously rotate or oscillate the immersed wafer substrate in a plane parallel to the surface of the melt during growth in order to achieve essentially uniform growth over the wafer surface (col 1, ln 20-40). Kokta et al also teaches a heated substrate is rotated at 80 rpm (2 revolution clockwise, then 2 revolutions counter clockwise) (col 4, ln 10-35). It would have been obvious to a person of ordinary skill in the art at the time of the invention to modify the combination of O’Neill and Dauncey with Kokta et al’s oscillating the substrate to improve the uniformity of growth over the wafer.

7. Claims 1-3, 7-11 and 26 are rejected under 35 U.S.C. 103(a) as being unpatentable over O’Neill (US 4,243,472) in view of Dauncey (US 2,759,803) as applied to claims 27-29, 33-37 and 52 above, and further in view of Kokune et al (US 5,603,762) or Admission.

The combination of O'Neill and Dauncey teaches a method for liquid phase epitaxy of multiple wafers, note entire reference, comprising a crucible **14** filled with a melt material **16** to be epitaxially deposited on substrates (col 2, ln 15-35). O'Neill also teaches a substrate holder **10** and supporting a plurality of wafers **12** substantially horizontal and lowering and immersing the wafers into a melt to deposit a thin film on each wafer (col 1, ln 60-68) using a dipping rod member **18** connected at one end to a means for raising and lowering the substrate into the crucible (col 2, ln 36-67). O'Neill also discloses the substrate is disposed at a position set aside from the center of the crucible (Figs 2-4) and no part of the substrate is disposed at the center of rotation of the supporting rack ('803 Figs 1-2).

The combination of O'Neill and Dauncey does not disclose the step of rotating the crucible independently from the substrate.

In a method of liquid phase epitaxy, note entire reference, Kokune et al teaches a melt is placed is placed in a furnace and utilized for liquid phase epitaxial growth (col 5, ln 40-60). Kokune et al also teaches the melt held in a crucible is stirred by the rotation of the crucible and when a raw material for the melt is to melted in the crucible, this mixture is placed in the crucible a stirring shaft is inserted downwardly into the crucible and the mixture is stirred by the shaft (col 6, ln 50 to col 7, ln 5). Kokune et al also teaches a crucible is fixed onto a table **13** and the table is rotated by a motor, so that the melt is stirred inside the crucible (col 7, ln 15-40). Kokune et al teaches the crucible is rotated independently while the substrate is contacting the melt during crystal growth (col 9, ln 35 to col 10, ln 15 and Fig 13). It would have been obvious to a person of ordinary skill in the art at the time of the invention to modify the combination of

O'Neill and Dauncey with Kokune et al's rotation of the crucible to stir the melt, thereby improving the uniformity of the melt.

Admission teaches the rotation of crucible is applied in a liquid phase growth system. Admission also teaches the substrate is stationary and rotating only the crucible can make the substrate supporting means greatly simple and is advantageous for large sized liquid phase growth systems, this reads on applicants' crucible is rotated independently from the substrate during crystal growth. Admission also teaches when the crucible is rotated the in-plane distribution of growth rate is good (pg 8). It would have been obvious to a person of ordinary skill in the art at the time of the invention to modify O'Neill with Admission because rotating the crucible improves the in-plane distribution of growth rate.

Referring to claim 2, the combination of O'Neill, Dauncey and Kokune or the combination of O'Neill, Duancey and Admission teaches a substrate holder 1, this reads on applicant's supporting rack, and the holder is disposed so that the wafers are held substantially horizontal, this reads on applicant's in the direction substantially parallel to the flow of the melt in the crucible.

Referring to claim 3, the combination of O'Neill, Dauncey and Kokune or the combination of O'Neill, Duancey and Admission teach a rotation of the melt.

Referring to claim 7, the combination of O'Neill, Dauncey and Kokune or the combination of O'Neill, Duancey and Admission teach raising and lowering the substrate holder ('472 col 2, ln 30-50).

Referring to claims 10-11, the combination of O'Neill, Dauncey and Kokune or the combination of O'Neill, Duancey and Admission teaches the substrate comprises a plurality of

Art Unit: 1765

groups independent from one another and all groups are immersed in the same melt and the plurality of groups of substrates are disposed around the axis at the center of rotation of the supporting rack ('803 Figs 1-2).

8. Claims 4 and 30 are rejected under 35 U.S.C. 103(a) as being unpatentable over O'Neill (US 4,243,472) in view of Dauncey (US 2,759,803), and further in view of Kokune et al (US 5,603,762) or Admission as applied to claims 1-3, 7-11 and 26 above, and further in view of Igarashi et al (JP 11-228250), an English abstract has been provided.

The combination of O'Neill, Dauncey and Kokune or the combination of O'Neill, Duancey and Admission teaches all of the limitations of claim 4, as discussed previously, except a flow adjusting means is provided stationarily in the melt to make the flow of the melt inclined toward the center of rotation and/or the liquid surface of the melt.

In a method of crystal growth, Igarashi et al teaches a baffle plate 5 is attached to the inner peripheral surface of crucible 4, this reads on applicant's flow adjusting means provided stationarily in the melt, in a state inclined so that the upper side of the baffle plate become front side in the rotation direction of the crucible and then the crucible is rotated (Abstract). The inclined surface of the baffle plate, note Figs 2-3, inherently will direct the flow of the melt toward the center of rotation. It would have been obvious to a person of ordinary skill in the art at the time of the invention to modify the combination of O'Neill, Dauncey and Kokune or the combination of O'Neill, Duancey and Admission with Igarashi et al's baffle plate attached to the crucible to remove suspended matter on the melt surface, thereby increasing purity ('280 Abstract).

9. Claim 5 is rejected under 35 U.S.C. 103(a) as being unpatentable over O'Neill (US 4,243,472) in view of Dauncey (US 2,759,803), and further in view of Kokune et al (US 5,603,762) or Admission as applied to claims 1-3, 7-11 and 26 above, and further in view of Ukiyo et al (JP 11-199376), as English Abstract has been provided.

The combination of O'Neill, Dauncey and Kokune or the combination of O'Neill, Duancey and Admission teaches all of the limitations of claim 5, as discussed previously, except a flow adjusting means is provided rotably in the melt to make the flow of the melt inclined toward the center of rotation and/or the liquid surface of the melt.

In a liquid phase growing method, Ukiyo et al teaches melting a semiconductor and stirring structure independent of a substrate supporting stand and capable of carrying out the rotation and stirring independent of the supporting stand. Ukiyo et al also teaches the shape of a fin, this reads on applicant's flow adjusting means, for stirring is a twisted rectangular shape and the attaching angle thereof to the substrate supporting stand is 45° (Abstract and Fig 2). The shape of the fin, note Fig 2a, would inherently direct the melt toward the center of rotation. It would have been obvious to a person of ordinary skill in the art at the time of the invention to modify the combination of O'Neill, Dauncey and Kokune or the combination of O'Neill,

Duancey and Admission with Ukiyo et al's flow adjusting means to provide a liquid phase growing method by which efficient and homogeneous liquid phase growth on a substrate is enabled (' 376 Abstract)

Art Unit: 1765

10. Claim 6 is rejected under 35 U.S.C. 103(a) as being unpatentable over O'Neill (US 4,243,472) in view of Dauncey (US 2,759,803), and further in view of Kokune et al (US 5,603,762) or Admission as applied to claims 1-3, 7-11 and 26 above, and further in view of Burkhardt et al (US 5,902,394).

The combination of O'Neill, Dauncey and Kokune or the combination of O'Neill, Duancey and Admission teaches all of the limitations of claim 6, as discussed previously, except the crucible is rotated alternately in the clockwise and anticlockwise directions.

In a method of oscillating a crucible rotation, note entire reference, Burkhardt et al teaches a mechanism capable of rotating a crucible at various rates of rotation and varying the rates of rotation during a given period such that particles contained in the melt are reduced (col 2, ln 5-45). Burkhardt et al also teaches the rate of rotation is controlled to alternate between a forward rate of rotation (clockwise) and a reverse rate of rotation (counter clockwise) (col 4, ln 55-67). It would have been obvious to a person of ordinary skill in the art at the time of the invention to modify the combination of O'Neill, Dauncey and Kokune or the combination of O'Neill, Duancey and Admission with Burkhardt et al's oscillating crucible rotation between clockwise and counter clockwise rotation to reduce particles in a melt, thereby improving the quality of the crystal produced.

Response to Arguments

11. Applicant's arguments filed 2/20/2004 have been fully considered but they are not persuasive.

In response to applicant's argument that the examiner's conclusion of obviousness is based upon improper hindsight reasoning, it must be recognized that any judgment on obviousness is in a sense necessarily a reconstruction based upon hindsight reasoning. But so long as it takes into account only knowledge which was within the level of ordinary skill at the time the claimed invention was made, and does not include knowledge gleaned only from the applicant's disclosure, such a reconstruction is proper. See *In re McLaughlin*, 443 F.2d 1392, 170 USPQ 209 (CCPA 1971).

In response to applicant's argument that rotating the crucible or supporting rack during the crystal growth while no part of the substrate is disposed at the center of rotation causes uniform growth, the fact that applicant has recognized another advantage which would flow naturally from following the suggestion of the prior art cannot be the basis for patentability when the differences would otherwise be obvious. See *Ex parte Obiaya*, 227 USPQ 58, 60 (Bd. Pat. App. & Inter. 1985). The combination of O'Neill, Dauncey and Kokune or the combination of O'Neill, Duancey and Admission teaches a substrate holder, where the substrates are not disposed at the center of rotation and rotating the crucible during crystal growth. O'Neill teaches any apparatus capable of supporting and dipping a plurality of substrates in a melt filled crucible may be used so long as the apparatus is capable of raising, lowering and oscillating the substrates while in the flux (col 2, ln 25-35). Dauncey teaches a substrate holder, which meets all of the requirements of a substrate holder taught by O'Neill and the substrate holder holds the substrates in such a way that no part of the substrate is disposed at the center of rotation and holds a larger number of substrates than the holder taught by O'Neill. Therefore, it would have been obvious to a person of ordinary skill in the art at the time of the invention to modify the substrate holder of

O'Neill with the substrate holder of Dauncey to increasing productivity because a larger number of substrates could be processed than with the substrate holder taught by O'Neill. The Examiner has not relied upon "common knowledge" or "well-known in the art" rationale, merely the fact that increases in productivity are desirable.

In response to applicant's argument that the references fail to show certain features of applicant's invention, it is noted that the features upon which applicant relies (i.e., uniform growth on the substrate is more easily achieved due to the fact that the melt flows more slowly at the center of the crucible or supporting rack (pg 15)) are not recited in the rejected claim(s). Although the claims are interpreted in light of the specification, limitations from the specification are not read into the claims. See *In re Van Geuns*, 988 F.2d 1181, 26 USPQ2d 1057 (Fed. Cir. 1993).

Conclusion

12. The prior art made of record and not relied upon is considered pertinent to applicant's disclosure.

O'Neill (US 4,191,365) teaches a horizontal substrate holder for liquid phase epitaxy, note entire reference.

Iwane et al (US 2002/0108559) is a publication of application 10/022,545 to applicant,

which teaches similar features as claimed, note entire reference.

13. All claims are drawn to the same invention claimed in the application prior to the entry of the submission under 37 CFR 1.114 and could have been finally rejected on the grounds and art of record in the next Office action if they had been entered in the application prior to entry under

Art Unit: 1765

37 CFR 1.114. Accordingly, **THIS ACTION IS MADE FINAL** even though it is a first action after the filing of a request for continued examination and the submission under 37 CFR 1.114. See MPEP § 706.07(b). Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire **THREE MONTHS** from the mailing date of this action. In the event a first reply is filed within **TWO MONTHS** of the mailing date of this final action and the advisory action is not mailed until after the end of the **THREE-MONTH** shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than **SIX MONTHS** from the mailing date of this final action.

14. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Matthew J Song whose telephone number is 571-272-1468. The examiner can normally be reached on M-F 9:00-5:00.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Nadine Norton can be reached on 571-272-1465. The fax phone number for the organization where this application or proceeding is assigned is 703-872-9306.

Art Unit: 1765

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

Matthew J Song
Examiner
Art Unit 1765

MJS

NADINE G. NORTON
SUPERVISORY PATENT EXAMINER

